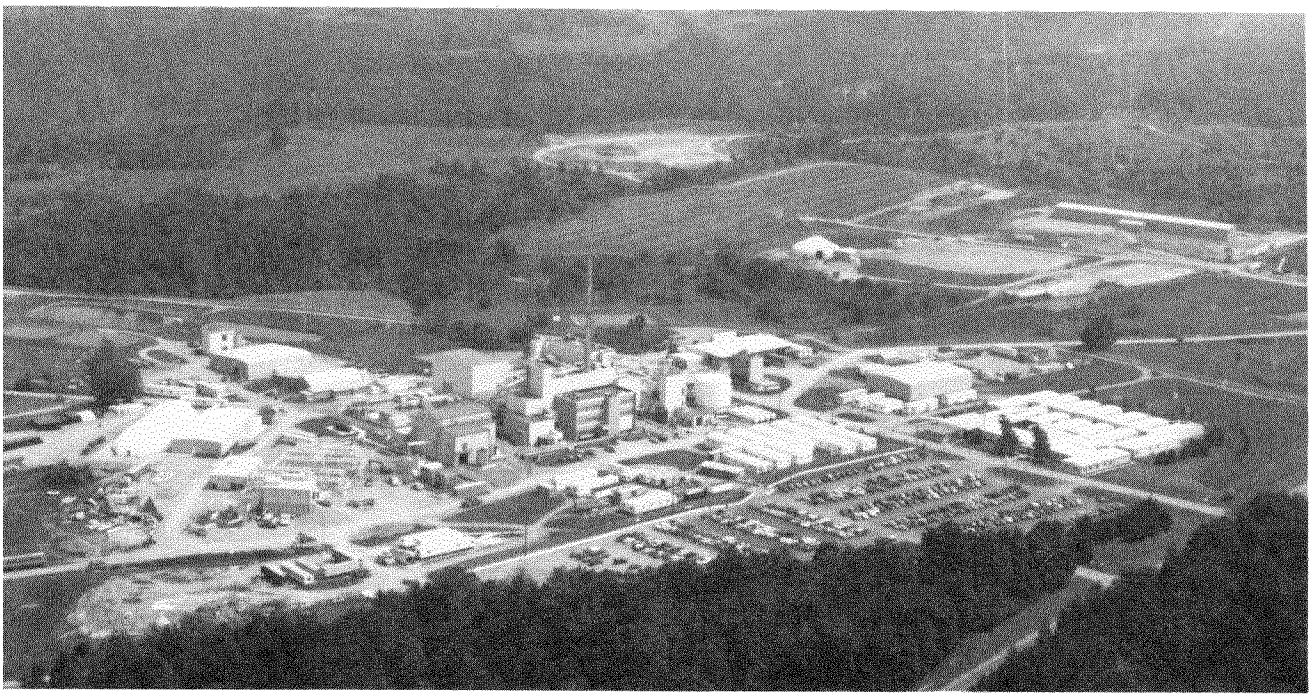

THE WEST VALLEY DEMONSTRATION PROJECT SITE

Executive Summary

The West Valley Demonstration Project (WVDP) conducts a comprehensive environmental monitoring program. This annual report presents a summary of the environmental monitoring data collected during 1989. The report is published in accordance with the requirements of United States Department of Energy (DOE) Orders 5484.1 and 5400.1. In addition to meeting DOE requirements, the site's environmental monitoring program fulfills regulatory requirements of the United States Environmental Protection Agency (EPA) and the New York State Department of Environmental Conservation (NYSDEC). In so doing, the program demonstrates that public health, safety, and the environment are being protected with respect to activities on the site and the waste materials stored there.

On-site and off-site radiological and nonradiological monitoring for 1989 confirm that site activities, with few exceptions, were conducted well within state and federal regulatory limits. The exceptions noted have resulted in no significant impacts upon public health or the environment and are described below.

History of the West Valley Demonstration Project

In the early 1950s, interest in promoting peaceful uses of atomic energy led to the passage of an amendment to the Atomic Energy Act under which the Atomic Energy Commission encouraged commercialization of nuclear fuel reprocessing as a way of developing a civilian nuclear industry. The Atomic Energy Commission made its technology available to private industry and invited proposals for the design, construction, and operation of reprocessing plants.

In 1961 the Office of Atomic Development acquired 3,345 acres near West Valley, New York and established the Western New York Nuclear Service Center (WNYNSC). The Davison Chemical Co., licensed by the New York Atomic Research and Development Authority, which later became the New York State Energy Research and Development Authority (NYSERDA), formed Nuclear Fuel Services, Inc. (NFS) to construct and operate a nuclear fuel reprocessing plant. NFS leased the Western New York Nuclear Service Center and began operations in 1966 to recycle fuel from both commercial and federally owned reactors.

In 1972, when the plant was closed for modifications and expansion, more rigorous federal and state safety regulations were imposed. Most of the changes were aimed at the disposal of high-level radioactive liquid waste and at preventing earthquake damage to the facilities. Compliance with these regulations was more costly than anticipated and, therefore, NFS decided in 1976 not to continue the plant modifications.

Following this decision the reprocessing plant was shut down. Under the original agreement between NFS and New York State, the state was ultimately responsible for both the radioactive wastes and the facility. Numerous studies followed the closing, leading eventually to the passage of Public Law 96-368 which authorized the Department of Energy to demonstrate a method for solidifying the 2.2 million liters (580,000 gals.) of liquid high-level waste that remained at the West Valley site. The technologies developed at West Valley would be used at other facilities throughout the United States. West Valley Nuclear Services Co. (WVNS), a subsidiary of Westinghouse Electric, was chosen by the Department of Energy to be operations contractor for the West Valley Demonstration Project.

The purpose of the West Valley Demonstration Project is to solidify the high-level radioactive waste left at the site from the original nuclear fuel reprocessing activities, develop suitable containers for holding and transporting the solidified waste, arrange transport of the solidified waste to a federal repository, dispose of any Project low-level and transuranic waste resulting from the solidification of high-level waste, and decontaminate and decommission the Project facilities.

Through the mid-1980s West Valley Nuclear Services, as prime contractor to DOE, secured environmental approval and constructed various subsystems that made possible the successful start-up of the Integrated Radwaste Treatment System (IRTS) in May 1988. In the first year of operation 523,000 liters (138,000 gals.) of liquid from the high-level waste tanks were processed through the IRTS. During the second year of operation, 1989, 931,000

liters (246,000 gals.) of liquid supernatant were processed.

Compliance

The West Valley Demonstration Project operates within the radiological guidelines of Department of Energy Orders for protection of health, safety, and the environment. Limits on radioactivity concentrations and individual doses are specified in the DOE Orders. The Project did not exceed or approach any of the limits on radioactivity or radiation doses in 1989, including the emission standards promulgated by the EPA and incorporated in DOE Orders.

Nonradiological plant effluents are permitted under New York State Department of Environmental Conservation (NYSDEC) and U.S. Environmental Protection Agency (EPA) regulations. New York State inspects nonradiological air emission points periodically even though air effluent monitoring is not currently required because of the nature of the discharges. Surface effluent water quality is tested for pH, biochemical oxygen demand, and other chemical factors and is regulated by the NYS Department of Environmental Conservation. The State Pollutant Discharge Elimination System (SPDES) permit identifies discharge water quality limits. In 1989 there were twenty-nine instances (5.5% of the measurements) when individual water quality parameters exceeded permitted levels, out of a total of 532 measurements. Six of these deviations resulted from natural variations in the iron content of raw water entering the plant. In each case, appropriate actions were taken to stabilize the condition and to notify NYSDEC in accordance with permit requirements. These deviations resulted in no significant impact on the environment.

Impacts upon site groundwaters are regulated by NYSDEC and the EPA. Groundwater sampling and analyses confirm that groundwater quality has been and continues to be affected both radiologically and nonradiologically by past facility operations. However, although definite radiological and nonradiological impacts upon groundwaters can be seen, these do not affect public health or the off-site environment.

Effluent And Environmental Monitoring

The 1989 environmental monitoring program provided radiological and nonradiological measurements of site effluent discharges and of other on-site and off-site samples. Collection of air and surface water samples provided monitoring of the two major pathways by which radioactive material could migrate off-site. Analysis of animal, soil, and vegetation samples from the facility environs provided data from which the risk of exposure to radioactivity through ingestion pathways could be determined. Control or background samples were taken to compare with on- or near-site samples. In 1989 the site recorded no abnormal radiological releases, and no special investigations of environmental radiological conditions were initiated.

Airborne particulate radioactivity was sampled continuously at five site perimeter and four remote locations during 1989. Sample filters were collected weekly and analyzed for gross alpha and beta radioactivity. Airborne gross activity around the site boundary was, in all cases, indistinguishable from background concentrations measured at the remote locations and was well below the Department of Energy limits. (See Appendix B). Direct monitoring of airborne effluents at the main plant stack and other permitted release points showed all discharges to be well below DOE or EPA effluent limitations. Nonradiological discharges from the site are regulated by NYSDEC; however, no special monitoring and reporting of nonradiological airborne effluents are required.

Four automatic samplers collected surface water at locations along site drainage channels. Samples were analyzed for gross alpha, gross beta and gamma activity, and for tritium and strontium-90. As a result both of past site activities and continuing treated liquid releases, average gross radioactivity concentrations continued to be higher in Buttermilk Creek below the West Valley Project site than at the upstream background sample point. Average concentrations below the Project site in Cattaraugus Creek are only marginally higher than background concentrations, i.e., upstream of the site, and only during periods of Lagoon 3 discharge. All Cattaraugus Creek concentrations observed are well below regulatory limits. Concentrations of cesium-137, strontium-90, and tritium were all below DOE guidelines at all locations, including Frank's Creek at the inner site security fence more than three miles from Cattaraugus Creek.

The low-level liquid waste treatment facility (LLWTF)contributes most of the activity released from the site in liquid discharges. In 1989 annual average concentrations of radionuclides were less than 30% of release guidelines. Downstream sediment concentrations of cesium-137 have remained constant at each sample point since the WVDP began making measurements, indicating that no accumulation is occurring as a result of Project activities.

Radioactivity that may pass through the food chain was measured by sampling milk, beef, hay, corn, tomatoes, beans, fish, and venison. The results were not very different from 1988 and corroborated the low calculated doses from site effluents.

Nonradiological liquid discharges are monitored as a requirement of the State Pollutant Discharge Elimination System (SPDES). Liquid discharge occurs at three permitted "outfalls" or points of final release to surface waters. Project effluents are monitored for biochemical oxygen demand (BOD), suspended solids, ammonia, iron, pH, oil and grease, and other water quality parameters. Monitoring indicated that nonradiological liquid discharges had no effect on the off-site environment.

Direct environmental radiation was measured quarterly in 1989, as in previous years, using thermoluminescent dosimeters (TLDs). Monitoring is carried out at forty-one points distributed around the site perimeter and access road, at the waste management units, at the inner facility fence, and at various background locations. No significant differences were noted among exposure rates measured at background stations and the WNYNSC perimeter locations. Some TLD data were also collected within the restricted area boundary to monitor the exposure from nearby radioactive waste handling and storage facilities.

Groundwater Monitoring

The WVDP is underlain directly by layers of glacial sand, clay and rock, and/or by layers of deposited lake and stream materials. Underlying bedrock is primarily Devonian shales and sandstones. As the material deposited across the site is not uniformly distributed, groundwater flow and seepage rates are uneven.

The 1989 groundwater monitoring program included on-site wells for surveillance of solid waste management units and off-site wells for drinking water monitoring. An on-site system of 14 wells, one groundwater seep, and a french drain (an underground, gravel-filled drainage channel) provided upgradient and downgradient monitoring of the low-level liquid waste treatment facility (LLWTF) lagoons, the high-level waste tank complex, the NRC-licensed disposal area, and other units. All wells comprising the on-site groundwater monitoring network were sampled eight times during 1989. After initial physical measurements at each well, samples were collected and analyzed for a variety of radiological and water quality parameters. The range of analyses performed was determined by regulatory requirements and site-specific concerns or needs. Statistical tests were performed to define real differences between up- and downgradient wells.

Data from groundwater monitoring around the LLWTF lagoons indicate that radionuclides from past plant operations have affected groundwater quality. Compared to background, both tritium and gross beta concentrations are elevated in groundwater surrounding the lagoon system. However, the level of tritium contamination has declined steadily since 1982, as indicated by measurements at the french drain outfall. Levels of gross beta activity appear to be rising slightly, as measured at the french drain outfall and at the well monitoring former Lagoon 1 (WNW86-05). Other measured parameters such as pH and conductivity have shown significant differences between upgradient and downgradient locations. Most notable are the sodium and chloride concentrations at the upgradient well (WNW86-06) within this unit. It is believed that these elevated salt concentrations are due to migration from the sludge ponds located just upgradient of well WNW86-06.

Data from monitoring wells around the high-level waste tanks do not suggest any impact of the stored high-level radioactive waste on the groundwater. However, significant differences between upgradient and downgradient wells do indicate that previous site activities have affected groundwater in this area. Most notable are elevated levels of gross beta activity and greater-than-detectable concentrations of 1,1-dichloroethane at wells WNW86-09 and WNW86-12.

Groundwater monitoring around the NRC-licensed disposal area (NDA) indicates no discernable impacts to the deeper deposits in the area, as indicated primarily by measurements for tritium. However,

one shallow well in the vicinity of the NDA (WNW82-4A1) has consistently shown elevated tritium levels. In addition, continued organic solvent migration was detected in other shallow wells within the NDA. Migration of contaminated solvent is currently the focus of a control and remediation effort within the NDA.

The potential effect of Project activities on near-site groundwater is monitored by biennial sampling of groups of designated private drinking water wells as well as by the on-site measurements. Monitoring of drinking water wells off-site continues to demonstrate that the site has had no effect on residential drinking water supplies.

Radiological Dose Assessment

Potential radiation doses to the public from airborne and liquid effluent releases of radioactivity from the site during 1989 were estimated via computer models. Potential radiation doses from ingestion of locally produced foods were also calculated and compared to results derived from the computer models.

An EPA-approved computer program (AIRDOS, CAAC version) was used to calculate hypothetical radiation doses from airborne effluents. The highest whole-body dose to a nearby resident was estimated to be 0.0046 mrem, which is 0.018 % of the EPA limit. The highest dose to any organ was estimated to be 0.046 mrem (to the thyroid), which is 0.061% of the EPA limit.

Computer modeling was also used to estimate a hypothetical maximum radiation dose from liquid effluents. The highest dose to an individual was estimated to be 0.051 mrem, which is 0.051% of the DOE limit. Overall, the average dose from air and liquid discharges to individuals within an 80 km (50 mile) radius from the site was calculated to be 0.000038 mrem.

Radiation doses estimated from maximum consumption rates of locally produced foods ranged from 0.023 mrem (fish) to 0.092 mrem (milk). These doses are similar in magnitude to the values reported in previous years.

The above conservatively high, hypothetical calculated doses can be compared to an average dose of 360 mrem per year to a U.S. resident from natural background radiation. The dose assessment described in Section 4.0 predicts an insignificant impact on the public's health as a result of radiological releases from the WVDP.

Quality Assurance

The Quality Assurance (QA) program overseeing environmental monitoring activities includes the production of data from both on-site and off-site sources. Commercial contract laboratories and their own internal QA programs are routinely reviewed by site personnel. In addition, commercial laboratories must perform blind analyses of standard or duplicate samples submitted by the WVDP Environmental Laboratory.

On-site monitoring activities are subject to quality control checks from the time of sample collection through sample analysis and data reduction. Specific quality checks include: external review of sampling procedures, specific calibrations using primary standard materials, participation in formal laboratory crosscheck programs (for example, with EPA and DOE); and outside auditing by organizations including the U.S. Nuclear Regulatory Commission (NRC) and Westinghouse Electric Corporation.

Environmental sample sharing and co-location of measurement points with the New York State Department of Health (NYSDOH) and the NRC continued in 1989, ensuring that selected samples and locations are routinely measured by two or more independent organizations.

Crosscheck program participation coupled with other internal quality control procedures and external laboratory checks verified the overall high quality of data gathered in 1989. General program adequacy and specific issues of quality assurance were examined by a number of off-site agencies during 1989, including the DOE's first "Tiger Team." Isolated problems of quality control and/or program design that were identified have been or are currently being remedied. Overall, the program was found to be satisfactory.

THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION ASSISTS IN FISH SAMPLE COLLECTION

Program Summary

The environmental monitoring program for the West Valley Demonstration Project (WVDP), which began in February 1982, has been developed to detect any changes in the environment resulting from Project activities and to assess the impact of any such changes on the human population and the environment surrounding the site. Among the several factors considered in designing the environmental monitoring program were the kinds of wastes and other byproducts produced by the processing of high-level waste; possible routes that radiological and nonradiological contaminants could follow into the environment; geologic, hydrologic, and meteorological site conditions; quality assurance standards for monitoring and sampling procedures and analyses; and the limits and standards set by federal and state governments and agencies. The monitoring network and sample collection schedule have been designed to accommodate specific biological and physical characteristics of the area. As new processes and systems become part of the program, additional monitoring points are selected for sampling.

Monitoring and Sampling

The environmental monitoring program is comprised of effluent monitoring, off-site environmental surveillance, and on-site monitoring in which samples are measured for both radiological and nonradiological components. It includes both the continuous recording of data and the collecting of soil, sediment, water, air, and other samples at various times.

On-line effluent monitoring and sampling of environmental media provide two ways of assessing the results of on-site radioactive waste processing. Continuous effluent monitoring allows rapid evaluation of the environmental impact of site activities. Sampling is slower because it must be followed by laboratory analysis of the collected material, but it is capable of detecting much smaller quantities of radioactivity from proportional amounts of media being measured.

Data Summaries

Appendix A summarizes the 1989 environmental monitoring schedule at both on-site and off-site locations. Samples are designated by a coded abbreviation indicating sample type and location. (A complete listing of the codes is found in the index to Appendix A). Appendix A lists the kinds of samples taken, the frequency of collection, the parameters analyzed, and the location of the sample points.

Appendix B provides a partial list of the radiation protection standards set by the Department of Energy.

Appendix C summarizes analytical data from air, water, sediment, and biological samples (meat, milk, food crops, and fish) as well as the direct radiation measurements. For example, concentrations of various radionuclides in treated water, in streams and creeks, off-site well water, and air discharged from the main processing plant, the cement solidification system, and the supernatant treatment system are all provided in Appendix C.

Appendix D provides the data from the crosscheck analyses of samples by both the WVDP and independent laboratories. Radiological concentrations in crosscheck samples of air, water, soil, and vegetation are reported here as well as chemical concentrations from water crosscheck samples.

Appendix E summarizes the data collected from groundwater monitoring. Tables and graphs report concentrations at various locations of parameters such as gross alpha and beta, tritium or cesium, dissolved metals and fluoride.

Permits

Data gathering, analysis, and reporting to meet permit requirements are an integral part of the WVDP monitoring program. Selected media are sampled and analyzed to meet Department of Energy criteria and plant Operational Safety Requirements (OSR). The West Valley Demonstration Project participates in the State Pollutant Discharge Elimination System (SPDES) as required by the New York State Department of Environmental Conservation (NYSDEC). The site operates under

state-issued air discharge permits for nonradiological plant effluents. Radiological air discharges must also comply with the National Emissions Standards for Hazardous Air Pollutants (NESHAP). (See the ENVIRONMENTAL COMPLIANCE SUMMARY and Appendix C-5 for more information and a list of permits).

Confidence Level

Because any two samples from the same homogeneous media (e.g., air, water) rarely will yield exactly the same measured value for a given parameter, the results of analyses can have only a limited degree of certainty, called *the confidence level*. For any chosen confidence level, e.g. 95%, upper and lower values can be calculated such that a measurement falling between those values will be a "true" value within the probability of the confidence level. The 95% confidence level used at the WVDP means that there is a 95% chance (19 out of 20) that the true value of the measured parameter is within the calculated range. (See Chapter 5 for a more detailed discussion of quality assurance statistics).

Exposure Pathways

The major pathways for potential movement of radionuclides away from the site are by surface water drainage and airborne transport. For this reason the environmental monitoring program emphasizes the collection of air and surface water. Samples are collected on-site at locations from which small amounts of radioactivity are normally released or might possibly be released. Such locations include plant ventilation stacks as well as various water effluent points and surface water seepage locations.

Air Pathways

Off-site sample collection locations include those areas considered most representative of background conditions and those areas most likely to be downwind of airborne releases. Among the criteria used to position off-site samplers are prevailing wind direction, groundwater and surface water drainage patterns, farm land usage, and population centers.

Air is continuously sampled at nine locations. Background samplers are located in Great Valley and Dunkirk, New York. Nearby community samplers are in Springville and West Valley, New York. Five samplers are located around the WNY Nuclear Service Center perimeter.

Effluent air emissions on-site are continuously monitored for alpha and beta activity with remote alarms to indicate any unusual rise in radioactivity. Air particulate filters which are retrieved and analyzed weekly for gross radioactivity are then composited quarterly and analyzed for strontium-90, isotopic gamma, and specific alpha-emitting nuclides.

Iodine-129 and tritium also are measured in effluent ventilation air. At two locations silica gel-filled columns are used to extract water vapor which is then distilled from the desiccant and analyzed for tritium content. Four samplers use activated charcoal adsorbent which is analyzed for radioiodine. The silica gel columns are retrieved weekly; the charcoal is collected monthly and composited quarterly.

Water and Sediment Pathways

Effluent water is collected regularly or, in the case of Lagoon 3, during release intervals, and analyzed for various parameters including gross alpha and gross beta, tritium, and pH. Additional analyses of composite samples determine metals content, biochemical oxygen demand, specific isotopic radioactivity, and conductivity.

On-site groundwater and surface water samples are collected regularly and analyzed, at a minimum, for gross alpha and beta, tritium, and pH. Selected samples are analyzed for conductivity, chlorides, phenols, heavy metals, biochemical oxygen demand, and other parameters. Potable water on the site is analyzed monthly for radioactivity and annually for hazardous constituents.

Off-site surface waters, primarily Cattaraugus Creek and Buttermilk Creek, are sampled both upstream of the Project for background radioactivity and downstream to measure possible Project contributions. Residential drinking water wells located near the site are sampled biennially and on-

site water is analyzed for the same parameters. Sediments deposited downstream of the facility are collected semiannually and analyzed for gross alpha, gross beta, and specific radionuclides.

Food Pathways

A potentially significant pathway is the ingestion and assimilation of radionuclides by game animals and fish that include the WVDP in their range. Appropriate animal and fish samples are gathered and analyzed for radionuclide content in order to reveal any long-term trends. Fish are collected at several locations along Cattaraugus Creek and its tributaries at various distances downstream from the WVDP.

Human consumption of game animals, fish, domesticated farm animals, and produce raised near the WVDP presents another pathway that must be monitored. Meat, milk, hay, and produce are collected at nearby farms and at selected farms well away from any possible WVDP influence.

Atmospheric Fallout

An important contributor to environmental radioactivity is atmospheric fallout. Sources of fallout materials include earlier atmospheric testing of atomic explosives and, possibly, residual radioactivity from the Chernobyl nuclear power plant accident. Four site perimeter locations currently are sampled for fallout using pot-type samplers that are collected every month. Long-term fallout is determined by analyzing soil collected annually at each of the nine perimeter and off-site air samplers and from an additional site in Little Valley, New York, twenty-six kilometers from the WVDP.

Direct Radiation

Direct penetrating radiation is continuously monitored using packets of TL-700 lithium fluoride (LiF) thermoluminescent dosimeters (TLDs) located on- and off-site. Monitoring points within the site are placed at waste management units and the inner facility fence. Other monitoring stations are situated around the site perimeter and access road and at background locations remote from the WVDP. (With the newest monitoring station in Sardinia activated at the beginning of the third quarter of 1989, forty-one monitoring points now exist). The measurement packets, five TLDs per packet, are retrieved quarterly and analyzed on-site to obtain the integrated gamma exposure.

Meteorological Data

Meteorological data are continuously gathered and evaluated on-site. Wind speed and direction, barometric changes, temperature, and rainfall are all measured. Such data are valuable when evaluating long-term trends and developing dispersion models. In the event of an emergency the data become an especially valuable tool for predicting the path and concentration of any material that becomes airborne.

Control of Quality

The work performed by the on-site environmental laboratory is regularly reviewed by several agencies for accuracy, compliance with applicable regulations, proper record keeping and reporting, timely calibration of equipment, training of personnel, adherence to accepted procedures, and general laboratory safety. Additionally, the environmental laboratory participates in several quality assurance programs administered by federal agencies. Outside laboratories contracted to perform analyses for the WVDP are regularly subjected to performance audits.